PATENT SPECIFICATION

Application Date: July 19, 1926. No. 18,064/26. 282,125

Complete Left: March 4, 1927.

Complete Accepted: Dec. 19, 1927.

PROVISIONAL SPECIFICATION.

Improvements in or relating to Two-stroke Cycle Internal Combustion Engines.

I, CECIL LAW, a subject of the King of Great Britain, of 3, Brentmead Place, Golders Green, in the County of London, do hereby declare the nature of this invention to be as follows:—

This invention has reference to two-stroke cycle internal combustion engines of the kind wherein the individual pistons of pairs of axially aligned pistons are respectively connected to separate crank shafts, each pair of pistons being capable of reciprocatory motion in its respective cylinder.

According to this invention, the cranks which are provided on the separate shafts and are respectively connected with each pair of pistons are so set relatively to each other that during portions of each cycle of working, the pistons move in the same direction and during the other portions move in opposite directions, the shafts being geared with each other for maintaining the relative setting of the cranks thereof. By setting the cranks in this manner the space between each pair of pistons when moving in the same direction is of a constantly changing capacity, the movement to and from each other of the pistons of each pair being gradual and varying owing to the relative positions of the pistons and the crank pins connected therewith. With such an arrangement the compression and the expansion following firing, of the charge are comparatively slow and inducive to smooth running of the engine. Each cylinder is provided with two exhaust ports capable of being uncovered by the respective pair of pistons and with inlet ports for the admission of scavenging air and the combustible mixture. Preferably, the scavenging air is admitted under pressure and is controlled by one of the pistons, the uncovering of one of the exhaust ports and the scavenging air inlet occurring simultaneously, while the admission of the combustible mixture follows the introduction of the scavenging air into the cylinder and occurs simultaneously with the opening of the other exhaust port, both of which are controlled by the other piston. Thus the inlet of scavenging air serves to expel some of the waste products of combustion at one end of the cylinder while the remainder are expelled by the admission of the combustible mixture. The latter and a small proportion of the scavenging air left in the cylinder are then compressed following which the charge is fired, such firing being effected after the pistons have commenced their movement from each other, although they may be moving at the moment in the same direction.

In one construction, wherein the crank shafts are rotated in the same direction, the cranks are preferably so arranged in relation to each other for each pair of pistons, where more than one pair is employed, that one is 270° in advance of the other, and by chain, tooth or other suitable form of gearing, the shafts are caused to rotate relatively to each other in this relationship. In this arrangement, the firing of the charge occurs when one of the cranks is in close proximity to its dead centre position and is 270° to the rear of the other crank which is in its most effective angular position for transmitting to its shaft the full effort exerted by the fired charge. Owing to this disposition of the relative cranks of the pair of associated pistons, the crank in its most effective position serves to move the other crank past its dead centre position during a very slight expansion of the fired charge, following which the latter exerts practically the whole of its expansive effort on the two cranks through the pistons connected therewith.

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In an alternative construction the shafts are geared together to rotate in opposite directions and the cranks connected with one pair of pistons are so positioned relatively to each other that at the firing of the charge, one crank is about 75° in advance of its inner dead centre position, while the other crank is within about 15° of its inner dead centre position and following the firing of the charge, is moved past the latter by the effort exerted through the first mentioned crank which is at a much greater angular distance from its inner dead centre position than the crank to be moved past its inner dead centre position.

It will be understood that although two examples of the relative angular positions of the cranks are herein given, these positions can be considerably varied without departing from the nature of the invention provided that during certain portions of the two stroke cycle the pistons are moving in the same direction and at other times in opposite directions. The firing of the charge is effected through any suitable device which is adapted therefor and may be adjustable, if desired; while the introduction of the scavenging air and the combustible mixture into the cylinder may be effected by suitable pumps or equivalent means or from the crank chambers of adjoining cylinders.

Dated this 19th day of July, 1926.

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15, Park Row, New York, N.Y., U.S.A.,
Agents for the Applicant.

COMPLETE SPECIFICATION.

Improvements in or relating to Two-stroke Cycle Internal Combustion Engines.

I, CECIL LAW, of 3, Brentmead Place, Golders Green, in the County of London, a subject of the King of Great Britain, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention has reference to two stroke cycle internal combustion engines of the kind wherein pairs of axially aligned pistons are disposed on opposite sides of a common combustion space in the cylinder and are adapted during portions of each cycle of working to move in the same direction and during the other portions to move in opposite directions. In a previously proposed construction of engine of this character the pistons are adapted to compress the scavenging air and combustible mixture prior to the introduction of the same into the combustion space. The primary object of the invention is to provide improvements whereby the construction is materially simplified by the elimination of valves which have heretofore been considered necessary for the proper running of the engine.

According to this invention, the cylinder is provided with two sets of inlet transfer and exhaust ports respectively controlled by a pair of pistons capable of operating as hereinbefore referred to, each piston being adapted to control its respective set of ports in the cylinder. The pistons are preferably arranged to compress scavenging air and combustible mixture in casings prior to the introduction of the air and mixture into the combustion space, the casings being connected to the cylinder and the passage of the compressed air and mixture to the combustion space being controlled by the respective pistons. Preferably the pistons are arranged in conjunction with cranks or the equivalents thereof so set relatively to the firing of the charge that one crank or the equivalent thereof is set 45° in advance and the other 45° to the rear of the dead centre positions.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be fully described, by way of example, with reference to the accompanying drawings, in which:—

Figure 1 is a sectional elevation illustrating an arrangement of one pair of pistons connected to a pair of geared crank shafts.

Figure 2 is a sectional elevation of two pairs of pistons connected to the same shaft.

Referring to the construction shewn in Figure 1, the crank shafts *a* and *b* are rotatable in the same direction through the medium of chain wheels *c* and an endless chain c^1. The cranks *d* and *e* are preferably so arranged in relation to each other that one crank *d* is 270° in advance of the other crank *e*, the crank shafts being caused to rotate in the same direction in this relationship by the said chain.

gearing c and c^1, although other suitable forms of gearing may be used for the purpose. In thus arranging the cranks, they are so disposed relatively to each other in the approximate firing position, that the crank d is 45° in advance of the inner dead centre position and the other crank e is 45° to the rear thereof, the crank d being in its most effective angular position for transmitting to its shaft a the full effort exerted by the fired charge, while the other crank e is advancing to this effective position for continuing the full effect of the expanding gases. Owing to this disposition of the cranks d and e of the pair of associated pistons f and f^1, the crank d, when in its most effective position, serves through the chain gearing to move the other crank e past its dead centre position during the expansion of the fired charge, following which the latter exerts practically the whole of its expansive effort on the two cranks d and e through the pistons f and f^1 connected therewith, during the outward strokes of the latter. The pistons f and f^1 are connected to the cranks d and e by the connecting rods g and g^1 and are enclosed in the cylinder h which is approximately twice the normal length of that provided for a single piston engine. Each end of the cylinder is closed by a crank casing j and j^1 and into the latter the air and mixture are respectively introduced and compressed during the reciprocations of the pistons. The compressed air and mixture pass by conduits k and k^1 into the cylinder when the ports k^2 and k^3 are uncovered by the pistons f and f^1. The inlet port l for the air and the inlet port m for the mixture are respectively controlled by the pistons f and f^1, the air and mixture being admitted when the pistons are near the ends of their inner strokes. When the pistons f and f^1 are near the outer limits of their strokes they uncover the ports k^2 and k^3 respectively as well as the exhaust ports n and the compressed air and mixture in the crank casings pass through the conduits k and k^1 and sweep the waste products of combustion from the cylinder through the exhaust ports n. o designates a recess in the cylinder for a sparking plug. With the arrangement of inlet ports shewn in Figure 1, it is feasible to provide means for supplying mixture through the air inlet port l as well as the mixture inlet port m, one form of means to this end comprising a valve controlled fuel supply pipe or jet attached to the air inlet pipe. The latter and the mixture inlet pipe are both provided with throttle valves and to the supply side of the throttle valve of the air inlet pipe is fitted the said fuel supply pipe or jet. With such an arrangement it is possible to supercharge the engine when required.

In an alternative construction the shafts a and b may be geared together to rotate in opposite directions and in this arrangement the cranks d and e connected with one pair of pistons are so positioned relatively to each other that at the firing of the charge, one crank is about 75° in advance of its inner dead centre position, while the other crank is about 15° to the rear of its inner dead centre position. Following the firing of the charge the latter crank is moved past its inner dead centre by the effort exerted through the first mentioned crank which is at a much greater angular distance from its dead centre positions than the crank to be moved past its inner dead centre position.

As regards the arrangement shewn in Figure 2, wherein two pairs of pistons f and f^1 are illustrated, these are connected to each other through the medium of swash plates a^2 and a^3 and a single shaft p, the latter being disposed between the cylinders h^1 and h^2 and being fitted with a flywheel q. The swash plates a^2 and a^3 are pivotally connected at their outer ends to the respective pistons and operate in conjunction with circular cams a^4 and a^5 provided on sleeves r secured to the shaft p. The sleeves r are disposed in casings j^2 and j^3 which are respectively equivalent to the crank casings j and j^1 of the construction described with reference to Figure 1, and are adapted for the introduction of air and mixture by inlet ports l and m. The casings j^2 and j^3 are placed in communication with the outer ends of the cylinders when the pistons are near the inner ends of their strokes, as shewn in the upper left hand portion of Figure 2. The air and mixture thus admitted into the cylinders are respectively compressed during the outward strokes of the corresponding pistons, and near the outer ends of such strokes pass through the ports k^2 and k^3 and conduits k and k^1 into the cylinders between the pairs of pistons for the purpose of expelling the waste products of combustion and recharging the cylinders with a combustible mixture capable of being fired by sparking plugs (not shewn) but adapted to be disposed in the recesses o. The waste products of combustion are expelled through ports (not shewn) but provided in the cylinders but approximately opposite to the ports k^2 and k^3 as in the construction described with reference to Figure 1.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is

to be performed, I declare that what I claim is:—

1. A two stroke cycle internal combustion engine wherein a pair of axially aligned pistons are arranged on opposite sides of a common combustion space in a cylinder provided with two sets of inlet, transfer and exhaust ports respectively arranged on opposite sides of the said space, the pistons being so set relatively to each other that during portions of each cycle of working they move in the same direction and during the other portions move in opposite directions, while each piston is adapted to control the set of the said ports in that part of the cylinder in which it operates.

2. An engine as in Claim 1, wherein scavenging air and combustible mixture are compressed by the pistons in casings connected with the cylinder and the pistons control the passage of the compressed air and mixture to the combustion space.

3. An engine as in Claim 1 or 2, wherein the pistons are arranged in conjunction with cranks or the equivalents thereof so set relatively to the firing of the charge that one crank or the equivalent thereof is 45° in advance and the other 45° to the rear of the inner dead centre positions.

4. A two stroke cycle internal combustion engine constructed and arranged substantially as hereinbefore described with reference to either of the examples illustrated in the accompanying drawings.

Dated this 4th day of March, 1927.

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Agents for the Applicant.

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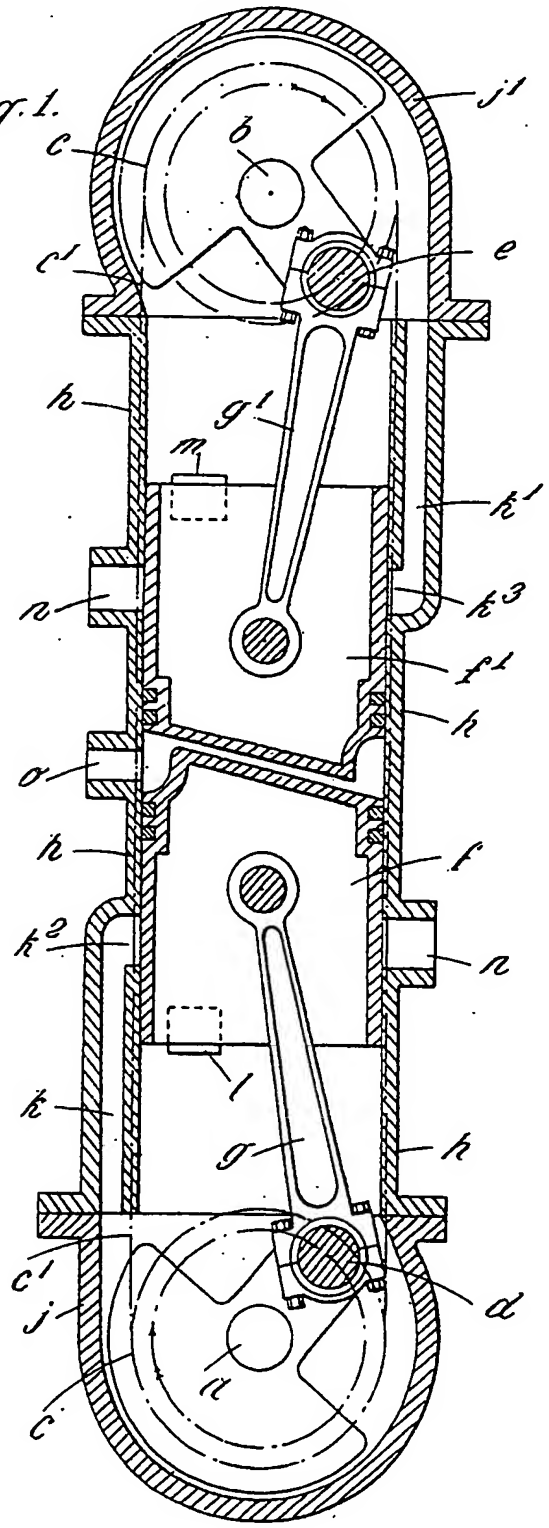
[This Drawing is a reproduction of the Original on a reduced scale]

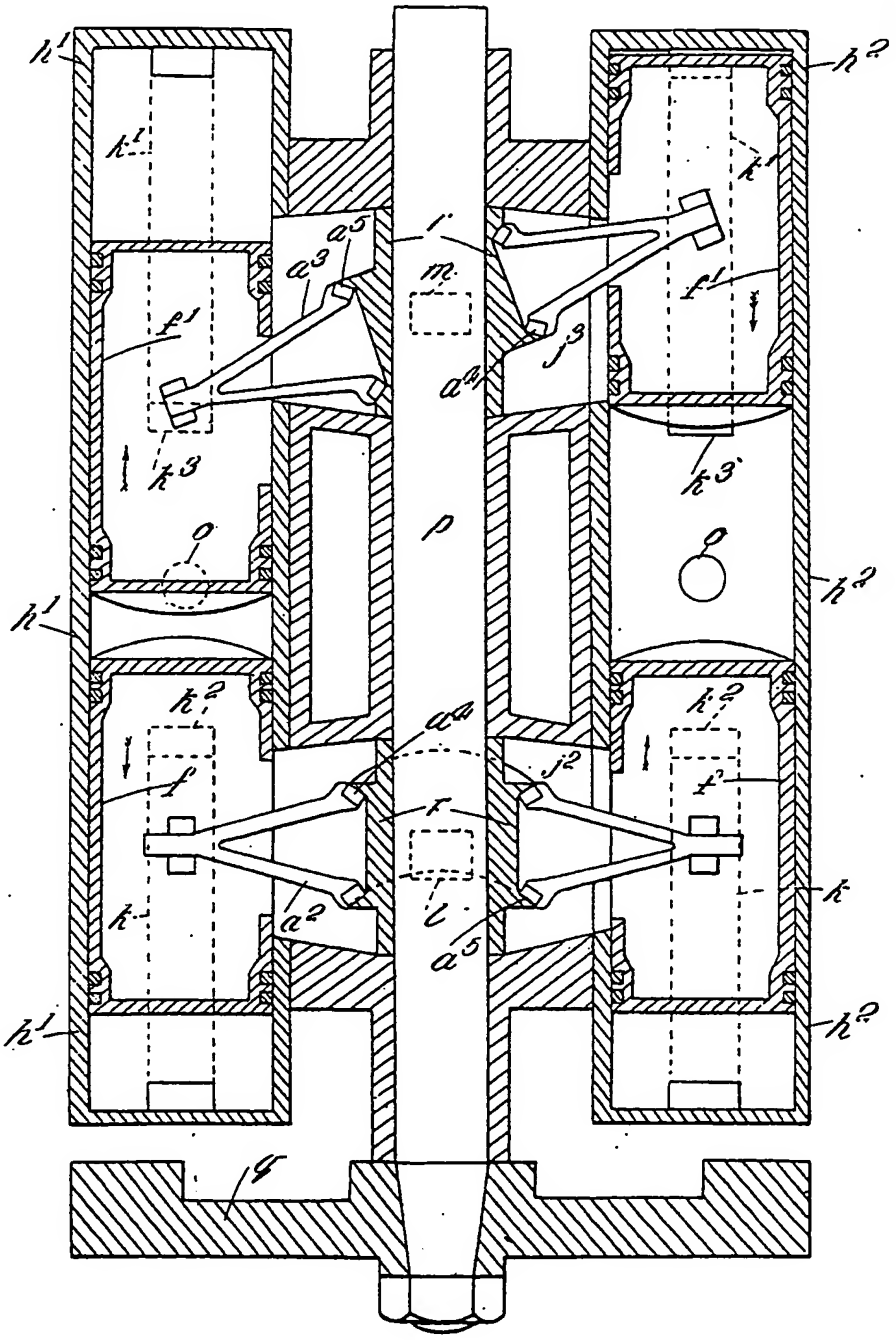
Fig. 1.



SHEET 1

2 SHEETS
SHEET 2

Fig. 2.



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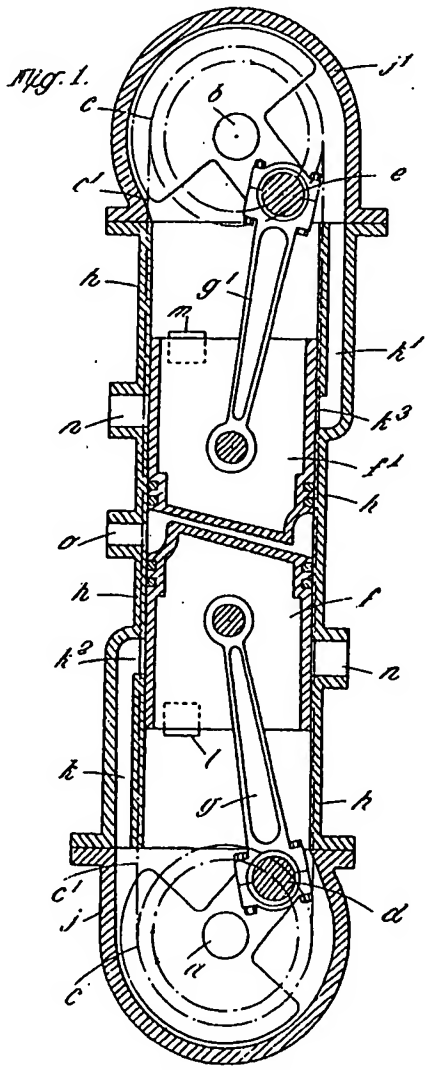
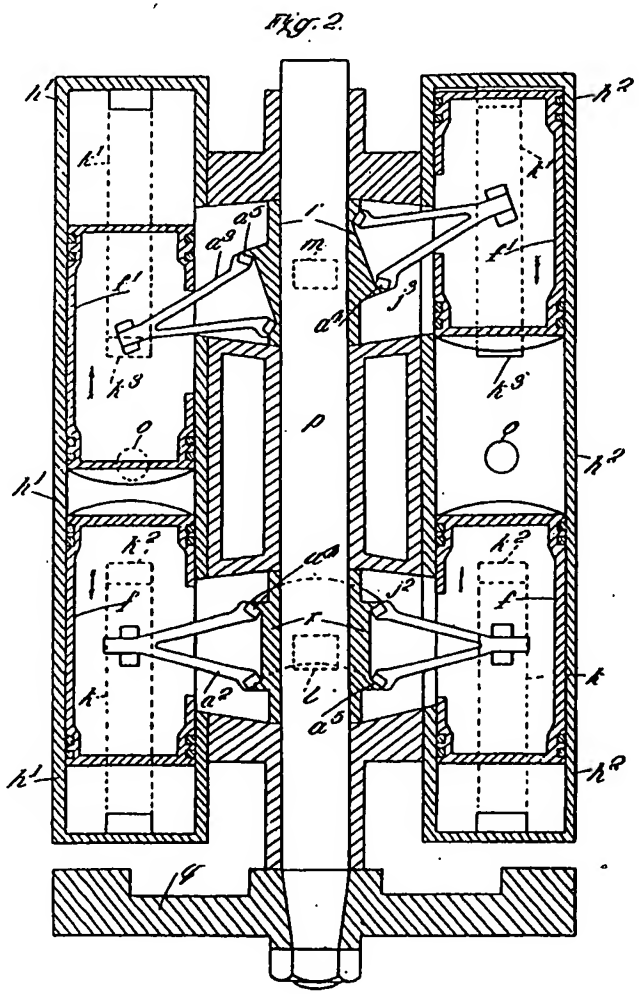
282,125 COMPLETE SPECIFICATION

2 SHEETS

SHEET 1



SHEET 2



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